APPARATUS FOR MONITORING, REGULATING, OR CONTROLLING FLUID FLOW

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Ser. No. 62/879,010 filed Jul. 26, 2019 and entitled APPARATUS FOR MONITORING, REGULATING, OR CONTROLLING FLUID FLOW (Attorney Docket No. Z87), which is hereby incorporated herein by reference in its entirety.

BACKGROUND

Relevant Field

[0002] The present disclosure relates to monitoring, regulating, or controlling fluid flow. More particularly, the present disclosure relates to a system, method, and apparatus for monitoring, regulating, or controlling fluid flow, for example, for use in medical applications such as intravenous infusion therapy, dialysis, transfusion therapy, peritoneal infusion therapy, bolus delivery, enteral nutrition therapy, parenteral nutrition therapy, hemoperfusion therapy, fluid resuscitation therapy, or insulin delivery, among others.

Description of Related Art

[0003] In many medical settings, one common mode of medical treatment involves delivering fluids into a patient, such as a human, animal, or pet. The need may arise to rapidly infuse fluid into the patient, accurately infuse the fluid into the patient, and/or slowly infuse the fluid into the patient. Saline and lactated ringers are examples of commonly used fluids. Such fluids may be used to maintain or elevate blood pressure and promote adequate perfusion. In the shock-trauma setting or in septic shock, fluid resuscitation is often a first-line therapy to maintain or improve blood pressure.

[0004] Delivery of fluid into the patient may be facilitated by use of a gravity-fed line (or tube) inserted into the patient. Typically, a fluid reservoir (e.g., an IV bag) is hung on a pole and is connected to the fluid tube. The fluid tube is sometimes coupled to a drip chamber for trapping air and estimating fluid flow. Below the fluid tube may be a manually actuated valve used to adjust the flow of fluid. For example, by counting the number of drops formed in the drip chamber within a certain amount of time, a caregiver can calculate the rate of fluid that flows through the drip chamber and adjust the valve (if needed) to achieve a desired flow rate.

[0005] Certain treatments require that the fluid delivery system strictly adhere to the flow rate set by the caregiver. Typically, such applications use an infusion pump, but such pumps may not be used in all situations or environments.

SUMMARY

[0006] Briefly, and in general terms, the present disclosure relates to a system, method, and apparatus for monitoring, regulating, or controlling fluid flow, for example, for use in medical applications such as intravenous infusion therapy, dialysis, transfusion therapy, peritoneal infusion therapy, bolus delivery, enteral nutrition therapy, parenteral nutrition therapy, hemoperfusion therapy, fluid resuscitation therapy, or insulin delivery, among others. More particularly, the present disclosure relates to a fluid flow meter for monitoring the flow of fluids associated with a patient, a valve for regulating the flow of fluid associated with the patient, and/or a fluid flow meter coupled to a valve (e.g., arranged in a closed-loop, open-loop, or feedback configuration) to monitor, regulate and/or control the use of fluid associated with the patient.

[0007] In an embodiment of the present disclosure, an apparatus for infusing fluid into a patient includes a housing, a tube-contact member, a rotating arm, and a tube-retention cover. The housing has an opening on a front side of the housing. The opening is sized to receive a drip chamber having an inlet tube and an outlet tube. The tube-contact member contacts one of the inlet tube and the output tube of the drip chamber when inserted into the opening. The rotating arm is coupled to the tube-contact member and is configured to rotate along an axis. The tube-retention cover is configured to close when the drip chamber is initially loaded into the opening.

[0008] In exemplary embodiments, the rotating arm may be a split-rotating arm. The split-rotating arm may comprise an arm portion and a tube-engagement portion. the tube-engagement portion may include the tube-contact member. The arm portion may include first and second catches.

[0009] The apparatus may include a carriage having a pin configured to engage with the first and second catches. The carriage may be coupled to the tube-retention cover to open or close the tube-retention cover in accordance with actuation of the carriage. A torsion spring may rotationally bias the tube contacting portion against the arm portion of the split-rotating arm. The apparatus may include a slide-clamp keyhole such that when the drip chamber is initially loaded, the rotating arm rotates to a first direction.

[0010] A backlight may be positioned behind the drip chamber to direct a light toward an opening of the drip chamber. The backlight shines light through the drip chamber and out of the opening of the housing.

[0011] A background pattern may be disposed on an inner wall within the opening of the housing and a background light may be configured to illuminate the background pattern. A backlight may be positioned behind the drip chamber to direct a light toward an opening of the drip chamber. A modulation circuit may be configured to module the background light and the backlight. The background light and the backlight may be modulated out of phase with each other.

[0012] The apparatus may include a top light disposed on a top of the apparatus. The top light may be a diffuse light forming a layer on the top of the apparatus. The apparatus may include a window disposed on the housing, and a flag configured for display in the window when the tube-retention cover is closed to retain the drip chamber.

[0013] In some embodiments, the apparatus includes a dock configured to retain the housing. A battery may be disposed within the housing. The dock may include a magnetic coupler and the battery is coupled to a charging coupler, and the dock is configured to communicate energy from the magnetic coupler to the charging coupler when the housing is docked within the dock.

[0014] The dock may further include a power supply coupled to A/C power via an A/C cord the magnetic coupler to communicate energy from the magnetic coupler to the charging coupler. The dock may include a transceiver configured to communicate wirelessly and may include a tilt